

BIBLIOGRAPHY ON GROUND-WATER POLLUTION AND
WASTE WATER PURIFICATION

G. De Vries

FACILITY FORM 602	N66 33720	_____
	(ACCESSION NUMBER)	(THRU)
	<u>57</u>	<u>1</u>
	(PAGES)	(CODE)
	_____	<u>13</u>
	(NASA CR OR TMX OR AD NUMBER)	(CATEGORY)

Translation of "Bibliografie Grondwaterverontreiniging
en Afvalwaterzuivering"Technisch Documentatie- en Informatie-Centrum
Voor de Krijgsmacht, The Hague, June 1965

GPO PRICE \$ _____

CFSTI PRICE(S) \$ _____

Hard copy (HC) # 2.50Microfiche (MF) .50

ff 653 July 65

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
WASHINGTON JULY 1966

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*Taken from Dokumentation Wasser (Water Documentation).

**Taken from a bibliography of the Rijksinstituut voor Drinkwatervoorziening (National Institute of Drinking Water Supply).

33720

ABSTRACT

This bibliography is meant as an introduction to literature on the subject of ground water pollution and waste water purification. It contains: abstracts from articles and reports, a list of Dutch institutions engaged in water purification and the quality of open water and ground water in Holland, and a list of the most important periodicals on this subject.

O LIST OF INSTITUTIONS ACTIVE IN THE FIELD OF WATER PURIFICATION AND THE 1*
QUALITY OF OPEN WATER AND GROUND WATER IN THE NETHERLANDS

Extract from "Directory of Water Works in the Netherlands," ed. VEWIN,
Churchill-laan 273, Rijswijk, Z. H.

See also: "The Organization of the Control of Water Pollution in the
Netherlands" by J. J. Hopmans, in "Water", 46, (1962), (1), (1).

1. KIWA, Waterworks Inspection Institute
Sir Winston Churchill-laan 273, Rijswijk, Z. H. 070-902 720
2. KIWA, Commission on Methods of Bacteriological Research
Secretary: Dr. P. Spaander,
1 Brandenburgerweg 78b, Bilthoven. 03402-4141
3. Ministry of Social Affairs and Public Health,
Department of Environmental Hygiene
C.F.J.J.M. van Nispen tot Sevenaer
Zeestraat 73, The Hague. 070-183 220
4. Netherlands Society for Prevention of Water, Soil, and Air Pollution
Secretary: Dr. T. J. Kingma Boltjes,
Laboratory for Microbiology,
Mauritskade 57A, Amsterdam. 020-946 321
5. National Institute for Drinking Water Supply
Parkweg 13, Scheveningen. 070-514 441
6. National Institute for Drinking Water Supply,
Commission for the Protection of Waterworks in War Conditions
Parkweg 13, Scheveningen.
7. National Institute of Public Health, Soil, Water, and Air Laboratory
1 Brandenburgerweg 78b, Bilthoven. 03402-4141
8. RIZA, National Institute for Purification of Waste Water** 2
Westeinde 3-A, Voorburg. 070-865 255
9. State Inspection for Public Health, Main Inspection for Environmental
Hygiene
N. J. A. Groen. 070-545 503
10. TNO. Institute for Health Care-TNO,
Department of Water and Soil
Dr. J. K. Baars, Schoenmakerstr. 97, Delft.
11. VEWIN, Society of Waterworks Management in the Netherlands
Sir Winston Churchill-laan 273, Rijswijk, Z. H. 070-902 720

*Numbers given in margin indicate pagination in original foreign text.

**With extensive library.

1 GROUND-WATER POLLUTION

13

1.1 List of the most important journals

1. "Water"
2. "Water and Soil"
3. "The Health Engineer"
4. "Gas and Water Specialty: Water, Waste"
5. "Deliwa Journal"
6. "Engineering News Record"
7. "Journal of the American Waterworks Association"
8. "Water Technology"
9. "Water Documentation" (Abstract Journal of the German Water Research Working Committee).

1.2 Quality of the ground water and the danger of pollution

001 KIWA bibliography
POLLUTION OF GROUND WATER, SURVEY OF THE LITERATURE TO 1954

R. D. Mulder

KIWA (July 1954) 42 pp., 178 refs., 4 tables

This survey of the most important literature on ground-water pollution, with references from about 1924 is divided as follows:

1. Introduction
2. Chemical and bacteriological pollution, salination, industrial waste
3. Threatened areas
4. Propagation and detection of contamination
5. Measures in various countries
6. Conclusions.

002 KIWA bibliography
DRINKING WATER SUPPLY

Twelfth Vacation course T. H. Highways and Hydraulics Engineering (Jan. 1960)
147 pp., 30 figures.

In this technical institute course, against the background of increasing water consumption and the qualitative decline of available sources, a survey is given of present research methods and the technical and legal measures to be carried out.

Contents:

14

1. Origin, properties and use of ground water
2. Ground water and vegetation
3. Lysimeters (measurement of ground-water evaporation)
4. Changes in the quality of water during its retention in the ground
5. Ground-water law and protection of places of water supply
6. Ground-water levels
7. The ground-water balance in the Netherlands.

003 KIWA bibliography
INTERNATIONAL WATER SUPPLY ASSOCIATION, FIFTH CONGRESS (June 1961), Berlin.
Vols. 1 and 2

1. WATER DISINFECTION, H. A. Faber
 2. THE POLLUTION OF SURFACE AND UNDERGROUND WATERS, W. Kumpf
- 1470 pp.

REPORT IN FRENCH AND ENGLISH OF THE FIFTH IWSA CONGRESS

Part I concerns, among other things, the disinfection of water (pp. 1-99), and the pollution of surface and ground water (pp. 103-132).

The situation and the field is reported by country, including financial and juridical problems with special discussion of possible radioactivity contamination.

Part II presents discussions of the reports (see Part I) concerning water disinfection on pp. 825-880 and concerning water pollution pp. 881-913.

004

VEWIN

5

REPORT ON THE PROTECTION OF GROUND WATER

VEWIN Commission on the Protection of Water Supply Sites

Publ. VEWIN (1964), 28 pp., 5 refs.

The report on the protection of ground water presents a survey of the causes of pollution that menace the ground water, present in water supply areas. After a survey of the study material consulted, the following are treated: mineral oil products, biological contamination, tourism, industry, insecticides and herbicides, refuse dumps, cemeteries, settling tanks, traffic.

The quality of the ground water must be safeguarded by land acquisition in the supply area and by legal measures. The report gives general indications for this.

005

WO 6266

PROTECTION OF WATERWORKS WITH RESPECT TO WAR CONDITIONS

Ministry of Internal Affairs and Ministry of Social Affairs and Public Health, 46 pp., 3 figures.

Drinking water supply is very important in wartime. In association with the special technical aspects that may arise when protecting waterworks in wartime, guidelines are compiled. In the measures here recommended, a distinction can be made between measures for protecting individuals and safeguarding them against danger on the one hand, and measures for maintaining the drinking water supply on the other hand. In addition to the task of self-protection that rests on every waterworks, special measures must be taken for protection of the facility, and additional measures for maintenance of the drinking water supply must be established in vital plants for which more detailed guidelines are set down. In the guidelines for waterworks, the entire complex of measures is considered without the intention to force the carrying out of these measures.

The guidelines are intended as a technical guide. General indications are given, by application of which a protection plan can be established, taking into consideration the character and importance of the facility as well as of local conditions.

006

TDCK 7301

BIOLOGICAL WARFARE AGAINST PUBLIC WATER SUPPLIES

Technical Bulletin

TB-11-18 (April 1955), 5 pp., 19 refs., 2 tables.

To prevent, recognize, and ward off a BW attack through public drinking water supplies, the following should be considered:

- a) Public drinking water supplies can be an attractive target.
- b) A wide variety of potential BW agents is available to the enemy, including those not normally associated with drinking water.
- c) It is likely that a BW attack through the water supply system would be either a one-shot effort to produce widespread illness in a number of target areas, or a more localized attempt directed at key persons, with the expectation that the sabotage might not be recognized. The recognition of a single act of sabotage involving water supplies would automatically lead to the application of extraordinary precautions in all target areas.
- d) The distribution system would be a more attractive target than the source of supply.
- e) Logistics would present no great difficulty.
- f) Substantial free chlorine residuals in important segments of the distribution system represent our best current protection. However, this protection may not be complete under all circumstances.
- g) Current routine bacteriological water quality examinations are not useful in detecting the presence of BW material.
- h) A BW attack may not be accompanied by readily detectable changes in physical characteristics of the water.

007

TH 1204 H

17

A REVIEW OF THE LITERATURE OF 1962 ON WASTEWATER AND WATER POLLUTION CONTROL, WPCF RESEARCH COMMITTEE

D. A. Okun, Chairman

Journal of the Water Pollution Control Federation, 35, No. 6, pp. 687-727, June 1963.

Several kinds of wastes and several methods of disposal are considered.

008

THE MATHEMATICAL LAWS GOVERNING GROUND-WATER MOVEMENT AND GROUND-WATER EQUILIBRIUM IN FLAT-LAND REGIONS

K. Ubell

Wasserwirtschaft-Wassertechnik, 11, No. 8, pp. 366-372, 1961.

009

THE INTERRELATIONSHIP BETWEEN HEAT AND WATER EQUILIBRIUM AND ITS EFFECT ON THE NEW FORMATION OF GROUND WATER

F. Kortüm

Wasserwirtschaft-Wassertechnik, 11, No. 8, pp. 354-357, 1961.

010

OIL AND DETERGENTS IN WATER AND WASTE WATER,
REPORT OF THE "WASTE WATER, FALL TERM COURSE 1961" OF THE BAVARIAN BIOLOGICAL RESEARCH INSTITUTE

Münchener Beiträge für Abwasser, Fischerei und Flussbiologie, Vol. 9.

011

GROUND-WATER CONTAMINATION

Proceedings of the Symposium on Ground-Water Contamination, (1961),
Robert Taft Center, Cincinnati, Ohio.

012

CONTROL AND PURIFICATION OF WATER

Transactions of the "Pro Aqua" Congress (1961), Basle.

/8

013

REPORT OF THE COMMISSION ON WATER LEGISLATION

Geschriften van de Vereniging voor Administratief Recht, No. 47, 1963.

1.3 BIBLIOGRAPHY ON GROUND-WATER POLLUTION 1960-1965

/9

014

DW 620347

POISONING OF DRINKING WATER BY CYANIDE-CONTAINING WASTE WATER

W. Knapp; and L. Hammer

Arch. f. Hygiene, 143, p. 501, 1959.

The great danger of poison-containing waste water from plants of the metal-working industry going into surface and drinking water is discussed. An installation water source received 10.8 mg/l cyanide water (limit value 0.01 mg/l). The source was connected with a dolina 250-meters distant, into which the bath liquid of an electroplating operation was carried. Preventive measures were proposed.

015

DW 611659

CONTAMINATION OF GROUND WATER BY DOMESTIC WASTE MATERIAL

H. Unger

Siedlungs-Wasserwirtschaft, No. 5/6, pp. 11-16, 1961.

The author discusses the nature and properties of domestic waste materials in developed areas, and then, in the light of pertinent guidelines and regulations, he investigates possibilities of contaminating ground water and the prevention thereof.

016

DW 611660

/10

GROUND-WATER QUALITY AND SOURCES OF CONTAMINATION

H. W. Davids; and J. M. Flynn

Public Works, 91, pp. 115-117, 1960. Figures. (Ref.: PHE Abstracts, 12/1960)

Complaints about poor water in some areas of Suffolk County made necessary comprehensive studies of water quality. Findings: It was established that 95 percent of all domestic waste water was carried into subterranean drainage systems. The basis for the form of disposal lies, on the one hand, in favorable soil conditions, and, on the other hand, in convenience. About 17,000 of 50,000 wells contain detergent, admittedly mostly in amounts that give no occasion for complaint. The chemical contamination will increase, however. Only about 5 percent of the houses are connected to sewer systems.

017

RELATIONSHIP BETWEEN SUBTERRANEAN WATER CONTAMINATION AND THE QUALITY OF THE GROUND WATER

E. Parakova; K. Enterova; A. Pavlikova; and J. Mayer. Csl. Hygiena, 5, No. 2/3, pp. 178-184, 1960. 3 figures. (Ref.: PHE abstracts, 5/1961)

The self-cleaning process of the ground in the vicinity of rural wells was investigated. The findings in the immediate vicinity of the site for

procuring water called attention to the influence of the contaminated ground on water quality. An experiment was therefore made with topsoil that had been contaminated artificially with fecal matter, manure, and a suspension of B. coli. The distribution of the contamination in distance and depth was investigated by bacteriological, chemical, and parasitological methods. An attempt was made to follow the course of the self-cleaning processes by determining the redox potential of the ground. The results show that the ground factors influence the water directly.

018 DW 621086 /11
SURVEY OF GROUND-WATER CONTAMINATION AND WASTE DISPOSAL PRACTICES

Task group report.

JAWWA, 52, No. 9, pp. 1211-1214, 1960. 1 table, 5 bibl. (Ref.: PHE Abstracts, 3/1961)

Nine of forty-eight states responded to a questionnaire to the effect that no contamination problems existed. Forty reported that no adequate controls prescribed by law existed. Only eight states reported new regulations or the strengthening of old ones. While 33 states permit the use of cesspools, 19 reported cases of ground-water contamination from such installations. It is to be expected that contamination will increase with the increasing use of such installations. Frequent ground-water contamination by detergents will make appropriate legal regulation necessary.

019 DW 611658
MIGRATION OF THE PRODUCTS OF URANIUM FISSION IN UNDERGROUND WATER

A. S. Belitskiy; and Ye. I. Orlova

Russian. Gigiyena i Sanitariya, No. 6, pp. 3-8, 1960. 5 figures. (Ref.: PHE Abstracts, 12/1960)

In the case of radioactive isotopes from uranium fission, the migration of ruthenium 106, cesium 137, and strontium 90 is of primary importance from the point of view of health.

Ru¹⁰⁶ is barely absorbed by rocks. Its distribution in the ground is therefore dependent upon the flow of ground water. The case is different with respect to Cs¹³⁷. Therefore its occurrence in ground water is limited.

Similarly, only small amounts of Sr⁹⁰ are carried by ground water to great distances from the site of contamination. Ultimately it all depends on local hydrological factors, including measures taken to protect the ground water against radioactive contamination.

020 DW 610844 /12
SURVEY OF GROUND-WATER CONTAMINATION AND WASTE DISPOSAL PRACTICES

JAWWA, 52, No. 9, pp. 1211-1219, 1960. 1 table, 5 bibl.

Numerous inquiries have been made in the 48 states of the U.S. since 1957 to determine the number of ground-water sources that are contaminated by sewage inflow. Nine states did not ascertain the existence of contamination, 26 reported complaints because of domestic waste, and 22 reported damage because of waste water from oil and gas processing plants. In 15 ground-water sites there was contamination with other industrial waste waters of the chemical industry. Critical comments. (ZWL, 60/405 I.)

021

DW 641513

UNDERGROUND HEATING OIL CONTAINERS IN CONNECTION WITH FURNACES--
INSTALLATION AND INSPECTION

J. Stossberger

Wasservers. u. Abwassertechnik, 14, No. 1, pp. 8-10, 1963.

General comment and technical remarks on various safety and protective measures connected with underground heating oil containers: overfill protection, steel-concrete tanks, double-wall steel containers with leakage indicators, steel containers with internal synthetic lining bags and prefabricated steel-concrete parts, and half tanks of prefabricated steel-concrete parts with leakproof sheathing of the upper part of the container of corrosion resistant material.

022

DW 620063

CONTAMINATION OF THE GROUND WATER IN SAARBRÜCKEN THROUGH SEEPAGE OF
HEATING OIL INTO THE SUBSOIL

Umschau Wiss. Technik, 61, No. 21, p. 661, 1961.

An example of the danger of oil seepage for drinking water supply is presented and counter-measures are indicated.

In the case described, 27 cubic meters of heating oil had seeped at a distance of only about 1 or 2 kilometers from a larger water procurement area. The prevailing hydrological conditions made pollution of the drinking water well probable. In accordance with a police regulation, extensive measures were at once carried out together with the appropriate state geological office for the protection of the drinking water supply. These measures, which extended over a period of several months, are reported.

023

DW 641204

GROUND WATER AND NEIGHBORHOOD PROTECTION

W. Langer

Der Städtetag, 15, No. 5, pp. 279-283, 1962. 3 diagrams, 16 bibl.

Dumps of solid waste materials can never be completely avoided. Also, in the case of trash burning, ashes and noncombustible materials are produced, while in a composting installation noncompostable residues and bulky materials remain.

Measures are presented which offer appropriate protection of the ground water against hazards arising from these residues.

024

DW 641205

THE EFFECT ON SURROUNDING UNDERGROUND WATER OF TIPPING HOUSEHOLD REFUSE
INTO WET GRAVEL PITS AT EGHAM

Proc. of the Soc. for Water Treatment and Examination, 11, part 2, pp. 23-31, 1962. 5 figures. (Ref.: PHE Abstracts, 5/63)

The effects of dumping refuse into several gravel pits over a period of about 20 years are discussed. It was found that coliform bacteria, organic substances (ascertained through the BSB load), and ammonia were not capable of migrating far through the ground. The effect of chlorides was in complete accord with the progress of refuse disposal.

025

DW 612122

/14

THE PROBLEM OF THE POLLUTION OF UNDERGROUND WATER SUPPLIES

J. H. Ch. Clarke

Water and Wastes Treatment Journal, 8, No. 5, p. 225, 1961.

The regions of central and southern England, which depend on the supply of ground water from fissured limestone strata, are increasingly threatened by sewage seepage from settling pits of existing and new communities, from new factories, etc.; by seepage of sewage-bearing river water; and by the use of abandoned quarries as refuse dumps. On the other hand the withdrawal of ground water has substantially increased. Existing difficulties can be successfully eliminated only for larger, geologically continuous areas.

Therefore, the responsibility of the river control offices must be expanded and their technical authority correspondingly enlarged.

026

DW 632324

CONTAMINATION OF GROUND WATER - VICINITY OF DENVER

W. N. Gahr

The Sanitarian, 24, No. 6, pp. 328-337, 1962. 3 figures, 10 bibl. (Ref.: PHE Abstracts, 10/62)

The author describes in detail several cases of pollution of a level water-bearing stratum by seepage from industrial waste and domestic sewage. He suggests a statutory regulation so that preventive measures can be taken and responsibility established.

027

DW 641514

/15

NITROGEN CONTENT OF GROUND WATER IN SOUTHERN CALIFORNIA

R. Navone; J. A. Harmon; and C. F. Voyles

JAWWA, 55, No. 5, pp. 615-618, 1963. 2 tables.

Investigation of the nitrogen content showed that ammonia nitrogen, organic nitrogen, nitrite, and nitrate are present in 700 drinking water procurement sites. Of the samples, 11.4 percent showed an NO_3 content $> 10 \text{ mg/l}$.

The nitrogen can originate from fertilizers, from waste water used for irrigation, and from seepage of domestic sewage.

028

DW 640907

RISE OF THE PHENOL CONCENTRATION IN THE SHORE FILTRATE WATER OF THE RHINE

H. Gross

GWF, 104, No. 30, p. 850, 1963. Diagrams.

Because of the long-lasting low water level in rivers and streams during the drought in the fall and winter of 1962-63, and because of the concentrated contamination of the shore-filtered ground water associated therewith, all surface wells in the Ludwigshafen region had to be shut down for a long period. Satisfactory drinking water in sufficient quantity was procurable from deep wells that had been developed in time. The increase in the phenol concentration of the Rhine at low water is illustrated graphically.

029

DW 621870

/16

RESEARCH NEEDS IN GROUND-WATER POLLUTION

J. E. McKee

J. Water Poll. Contr. Federation, 33, No. 12, pp. 1227-1233, 1961.

The author does not intend to enumerate individual research projects in this article, but he tries rather to determine which groups of projects should be pursued in order to increase knowledge in this relatively little-known field. He therefore classifies the problems to be studied into chemical (occurrence of nitrogen and sulfur compounds, of detergents, and of hydrocarbons); physical and mathematical (radioactivity, seepage, and sedimentation); biological (viruses and bacteria); and geological. Numerous questions are raised, which perhaps only qualified personnel could solve.

030

DW 630322

GROUND-WATER CONTAMINATION. PROCEEDINGS OF 1961 SYMPOSIUM

Robert A. Taft San. Engng. Center, USPHS, Cincinnati, Ohio. Technical Report W61-5, 218 pp., 1961. Numerous tables, figures, bibl. (Ref.: PHE Abstracts, 6/62)

Thirty-six papers were presented at the symposium on the following subjects: hydrologic views on ground-water contamination, types of pollution, special cases of contamination of ground water, and regulations and their administration as well as research in the field of ground-water pollution.

031

DW 622873

GROUND-WATER CONTAMINATION FROM CHEMICAL WASTE PRODUCTS

K. Sauer

GWF, 102, H. 36, p. 998, 1961. 1 bibl.

An example of ground-water pollution caused by chemical waste is described. The storage took place in basins where no particular attention was given to tightness. An area of 6.5 square miles was contaminated. Sinking the waste materials into a deep hole in the ground is considered. The rate and paths of migration of the seeping water, the harmful materials, and methods for their removal are reported.

032

DW 622343

POLLUTION OF WATER BY TIPPED REFUSE

British WWA Journal, 43, No. 6, pp. 357, 377, 1961.

It becomes increasingly difficult to find suitable land for the disposal of refuse. Numerous mines exist, however, that ought to be filled in order to put the land to useful employment again. In the past it was not considered desirable to dump household refuse in dry places where rainwater can seep through to aquifers, or into water-filled mines. The first part of the report notes the main results of experiments made over a period of a few years for the purpose of obtaining knowledge of the hazard. It is proposed to collect data on existing possibilities. Part 2 presents an exact description of the planning and execution of the experiments.

033

DW 631489

CONTAMINATION OF UNDERGROUND WATER SOURCES BY WASTES FROM THE
PRODUCTION OF POLYVALENT ALCOHOLS

A. Ye. Bessonov; and N. P. Pashchenko

Gigiyena i Sanitariya, Moscow, No. 6, pp. 59-62, 1962. 1 figure, 1 table.

The pollution of a source caused by negligence led to the appearance of aromatic odors. For better protection of the producing area, a second protective area ring was considered necessary.

034

DW 630323

/18

SILAGE WATER AS A CAUSE FOR THE CLOSING OF WELLS

R. Saalbreiter; and H. Lingelbach

Ztschr. ges. Hygiene u. ihre Grenzgebiete, 7, No. 4, pp. 248-257, 1961.

3 figures.

Until recently there has been little thought of drainage water from ensilage silos as a cause for the contamination of drinking water. The water from corn silos has a high content of organic material and contains a considerable amount of manganese and iron. Details are given on well contamination from this. In some cases the contamination persisted for several months. The taste and bacteriological threshold value for contamination by corn-silo water, according to the determinations, lies at a dilution ratio of 1:10,000.

It is recommended that silo water be collected in pits for utilization as fertilizer, as a simple measure for reduction of contamination hazard from yield areas.

035

DW 641515

INFLUENCE ON GROUND WATER, ESPECIALLY SHORE FILTRATE, BY THE RADIOACTIVITY
OF SURFACE WATER

D. Pätze

Dtsch. Gewässerkundl. Mitteilungen., 7, No. 2, pp. 44-46, 1963. 7 bibl.

Contamination of the ground water through a main drainage channel usually does not take place through the gradient ground-water drainage channel.

However, contamination could occur in wells in the vicinity of the shore.

Measurements carried out by the Ruhrverband are followed up. With the exception of a few extreme values, a decontamination factor of less than 10 was found. It is concluded that a danger of contamination of the drinking water supply would exist only if the surface water were to show a highly increased radioactivity for a long time.

036

DW 632325

/19

PROBLEMS IN GROUND-WATER POLLUTION

G. Walten

Robert A. Taft San. Engng. Center, USPHS, Cincinnati, Ohio. Technical Report W62-25, 6 pp., 1962. 1 figure, 14 bibl. (Ref.: PHE Abstracts, 12/62)

The growing problem of ground-water pollution is discussed quite generally. Various examples, including the case of Rocky Mountain Arsenal, are reported.

037

DW 622342

PLANT TOXICANTS IN UNDERGROUND WATER IN ADAMS COUNTY, COLORADO

E. K. Bonde; and P. Urone

Soil Science, No. 93, pp. 353-356, 1962. 1 figure, 6 refs.

Damage was done to plantings through the use of irrigation water originating in the vicinity of a chemical arsenal of the U.S. Army. This damage, as shown by X-ray, chemical, and pot experiments, primarily could be attributed to the presence of chlorate up to about 20 mg/l. Chlorate is evidently extremely stable in the ground water and in the ground. Furthermore a plant toxicant was identified in the ground water which caused damage similar to that of 2,4-Dichlorophenoxy acetic acid. This substance usually decomposes rapidly in the ground, but it apparently is very stable in ground water.

038

DW 641517

INSURANCE PROTECTION FOR OIL CONTAMINATION

O. Strauss

Mineralölgewirtschaft, No. 5, pp. 196-198, 200-201, 1963.

The author discusses fully the subject of liability insurance against damage claims for contamination of waters. The way in which the problem presents itself to the insurance companies is described. The bases /20 for the risk appraisal, and damages from petroleum transport are explained. The author discusses the bases for premium determination and defines new concepts such as salvage cost, cost of reducing damage, and legal costs. The various risk groups within the petroleum industry are investigated.

039

DW 631174

EXPERIENCES WITH GROUND-WATER CONTAMINATION IN UNSEWERED AREAS IN MINNESOTA

F. L. Woodward; F. J. Kilpatrick; and P. B. Johnson

Am. J. of Public Health and the Nation's Health, 51, No. 8, pp. 1130-1136, 1961. 2 tables.

The hygienic problems and nuisances that can arise from mass installation of private wells and settling pits in rapidly growing suburbs of large cities are discussed. Results of a check of the water quality in various individual water supplies in Coon Rapids, Minnesota (pop. 10,000) showed that 62.2 percent had a substantial amount of nitrate (1-21 mg/l) and that 23.6 percent of the installations contained surface active substances. Similar results were obtained in other areas. Influencing factors were well depth, population density, character of soil, and the direction and rate of ground-water flow. The orderly inclusion of suburbs appears to be indicated.

040

DW 630324

SYNTHETIC DETERGENTS IN GROUND WATERS

L. G. Campenni

Water and Sewage Works, 108, No. 5, pp. 188-191; No. 6, pp. 210-213; 1961. Orienting investigations of the U.S. Geological Survey showed synthetic /21 detergent contamination in six states. Contamination by detergents was confirmed in sand and gravel strata, and also in limestone and shale. The state promotion of construction on small lots with private water supply and drainage was discontinued.

Deepening of private wells, sealing the wells down to the water-bearing strata, and increasing the distance of the well from drainage does not suffice.

A lot size of 1,858 square meters is required to make a necessary minimum distance of 30.5 meters between well and drainage possible.

041

DW 641516

THE BEHAVIOR OF PETROLEUM DERIVATIVES IN GROUND WATER

E. Becksmann

GWF, 104, No. 24, pp. 689-694, 1963.

In the thorough investigation of the problem of oil and ground water, very peculiar findings have resulted with respect to the behavior of petroleum derivatives in ground water. A clarification of the disagreement between ideas and findings can be obtained by observation of the homogeneous flow as a model in hydrodynamics and as the special situation of capillary flow. The flow of immiscible liquids in the pore spaces of loose rock is thereby recognized as heterogeneous, i.e., multiphasic flow in interaction with inter-face tension.

Model of an oil leak is discussed, and suggestions for further work are made.

042

DW 622344

TROUBLE WITH OIL

R. Bucksch

Berichte der Landesforschung und Landesplanung, 6, No. 1, pp. 60-62, 1962.

Increase and decentralization of petroleum consumption makes for constant growth of the transport volume (rail, road, water, and pipeline) and especially for the number of storage and transfer points.

The threat to ground water connected therewith, and the damage that has /22 already taken place, must be counteracted in time and appropriately according to existing technical guidelines because, in spite of the progress of petroleum, the preservation of the water reserves must be guaranteed.

1.4 CONTAMINATION THROUGH OIL

/23

1.4.1 GENERAL

043

KIWA bibliography

POLLUTION OF WATER AND SOIL BY MISCELLANEOUS PETROLEUM PRODUCTS

International Water Supply Congress and Exhibition, Stockholm, June 1964.

General Report No. 2, (W. Zimmermann), 88 pp.

Contents:

- 1 - Introduction: production, transport, storage and its future development
- 2 - Causes of losses of oil and contamination of the soil
- 3/4 - Estimation of the magnitude of losses of oil and their effects
- 5/6 - Measures to be taken against the contamination of soil and surface water, and preventive methods
- 7/8 - Research and conclusion

app.: Methods for detection of mineral oil in the soil.
An 8-page summary is given in French.

044

K 71261

PROTECTION OF GROUND WATER AGAINST CONTAMINATION WITH PETROLEUM PRODUCTS
E. Zscherpe

VDI-Zeitschrift, 107, No. 9, pp. 412-414, March 11, 1965. 3 refs.

Even extremely small amounts of petroleum can make water unpalatable for humans. Petroleum storage therefore must be permitted in drinking water catchment areas only when special regulations are observed. As a preventive measure against intrusion of oil from leaky tanks or underground crude oil lines, troughs or channels of a carefully placed compact 40-centimeter-thick clay or loam layer have been found effective. In order to reduce the corrosion hazard in petroleum containers, it is necessary to follow appropriate regulations concerning material, manufacturing, testing, and installation.

The incorporation of optical and acoustic warning devices which /24
would indicate even a liter an hour of leaking oil is required for certain tank installations.

This report deals with causes and effects of contamination of the ground water, preventive measures against ground-water contamination, causes of the occurrence of leakage in tank installations and the prevention of damage.

045

M.B.

OIL CONTAMINATION OF LAKES AND RIVERS -- CAUSES AND CONTROL
H. Laucht

VDI-Zeitschrift, 97, No. 22, pp. 777-782, August 1, 1955. 5 figures, 9 refs.

The increase in sea transport of crude oil from the places where it is found to the refineries that has been going on in recent years, like the transition of ship operation from coal to oil, has lead to an increase in the "oil nuisance" caused by the draining of water-containing oil and oil residues into the sea or into river waters. However, it is possible with the devices available today to provide for purification of the drainage water under tolerable conditions, and even for utilization of the oil residues. Although some progress has been made, constant new information is still necessary.

046

TDCK

INVESTIGATION AND TESTING OF DEVICES FOR THE REMOVAL OF OIL FROM WATER
U. M. Rampf

Hansa, 99, No. 20, pp. 2071-2077, October 2, 1962. 10 figures.

In the present account some works are reported which were carried out at the research and test station for ship operation technique at the State Marine Engineering School at Flensburg on the order of the Federal Ministry for Transport.

The problem presented was the ascertainment and study of methods and /25
devices for the removal of oil from water. In connection with the work on this problem, some basic studies from other projects were included, which were not described in the literature or available from experience

elsewhere. These special partial tasks, their execution, and the knowledge obtained therefrom are presented.

A general description of the total project, its extent and execution, precedes the report.

The following subjects are treated exhaustively: oil removal with cascade tanks; the influence of operating temperature on the effectiveness of a water oil remover; and the influence of the type of pump construction on the oil removal process, and the chemical separation of oil-water mixtures. In this connection the construction, mode of operation, and chances of breakdown of oil removers of conventional design and their general characteristic magnitudes are briefly described.

All this work is available to the interested industry. The processing of the type testing for bilgewater oil removers has been turned over to us by the Minister for Transportation and will be carried out in the future. Further supplementary data are continuously obtained here, to verify our previous work or to supplement it.

047

K 70947

THE EARLE SYSTEM FOR OIL SLICK REMOVAL

The Navy Civil Engineer, 3, No. 8, p. 30, August 1962. 1 figure.

This method of removing oil from harbor waters is based on the same principle as offset printing.

Oil adheres to a rotating drum, is removed by a wiper blade from the drum into a trough from which it is pumped to the storage tank.

048

W.O. R.209

REMOVAL OF OIL SLICKS

/26

Navy Dept. Chemical Laboratory, Norfolk Navy Yard, Portsmouth, Virginia. January 11, 1964.

Removal of Oil Slicks

- I. Bn Ships Test No. 59/47 Norfolk No. 23 50.50.A (Modified) (14 pp., 6 figures.)
- II. Norfolk No. 21 2003 Nynor. Test No. 37/46, (18 pp., 2 tables, 4 figures.)
- III. Specification for carbonized sand for use in removing oil slicks on surface of water.

Carbonized sand is being used for the removing of oil slicks. Experimental units for manufacturing carbonized sand are described. An improved type of sand spraying unit is described.

Carbonized sand is a practical and inexpensive material for removing oil slicks.

When sufficient sand is spread on the oil slick to combine with the amount of oil present, the resulting mixture is easily sunk with any type of agitation, such as a water spray.

049

TDCK 34183

BURNING OIL ON WATER

Ch. W. L. Tupang

B.V.A.-M.G.D., Verslag, No. 51, 60 pp., January 1963. 40 figures.

In the report consideration is given to the danger connected with contamination of water by oil and the means for the prevention and control of it, especially the fire hazard.

In the development of these means, which are based on the behavior (rate of distribution and minimum layer thickness) of the various kinds of oil on water, the start is naturally made from the supposition that because of fire control regulations for every oil loading, unloading and storage place (provision of firewalls, etc.) normally only limited amounts of oil should be involved in a possible fire.

Because of greatly enlarged transport operations or tanker dimensions, this supposition is now no longer tenable, taking into account the enormous destructive power of the means (nuclear weapons) which can come into use in war conditions.

In connection with this study the question is raised as to what the consequences would be of a nuclear attack on the oil storage center near Pernis.

Since the consequences are dependent on various factors, various assumptions are made in answering the question.

050

ABOUT PETROLEUM AND ITS PRODUCTS IN THE SOIL AND IN GROUND WATER

Dr. M. Knorr

Water, 41, pp. 247-252, 276-280, 1957.

051

CONTROL OF CONTAMINATION OF SURFACE AND UNDERGROUND WATER

Hoffmann; Buxell; Leclerc; Birembant; Stundl; Schläpper;
and Bosshard

Symposium of the Federation for European Water Protection, F.E.G.,
Baden-Baden, 40 pp., January 23-24, 1959.

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OPINION ON THE QUESTION OF PROTECTION OF GROUND WATER AGAINST CONTAMINATION THROUGH STORED LIQUIDS

Michels; Nabert; Udluft; and Zimmermann

Federal Ministry for Atomic Energy and Water Supply, Bad Godesberg,
108 pp., June 1959.

053

SOIL CONTAMINATION THROUGH PETROLEUM PRODUCTS AND THE PUBLIC WATER SUPPLY ^{/28}

J. J. van Soest

Water, Boden en Lucht, 50, pp. 25-42, 1960.

054

PETROLEUM AND DRINKING WATER

H. Eilers

Water, Boden en Lucht, 50, pp. 58-86, 1960.

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PROBLEMS OF THE CONTAMINATION OF GROUND AND SURFACE WATER BY PETROLEUM AND DETERGENTS

E. Naumann

Schriftenreihe des Vereins für Wasser, Boden und Lufthygiene, No. 16,
Stuttgart, 1960.

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CONTAMINATION OF THE GROUND BY HEATING OIL AND MEASURES FOR ITS
PREVENTION

W. Langer
Ges. Ing., 83, pp. 89-95, 1962.

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H. Liebmann
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1.4.2.1 MOVEMENT OF OIL IN THE GROUND

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SANDCORES
C. B. Dale; R. M. MacFarlane; and R. V. Hughes
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PETROLEUM AND DRINKING WATER
H. Eilers
Water, Boden en Lucht, 50, pp. 58-82, 1960.

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GRANULAR MATERIAL
W. F. Engelberts; and L. J. Klinkenberg
World Petroleum Congress, Section II, The Hague, 1951.

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INVESTIGATIONS OF THE INFLUENCE OF INTERFACIAL TENSIONS AND MARGINAL
ANGLE ON THE DISPLACEMENT OF OIL BY WATER IN POROUS BODIES
W. Engelhardt; and H. Lübbem
Erdöl und Kohle, 10, pp. 747 and 826, 1957.

063 /31
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G. L. Hassler; E. Brunner; and T. J. Deahl
Petr. Techn., September 1943.

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OPINION ON THE DISTRIBUTION OF CRUDE OIL IN THE GROUND

W. Hensen

Hannoversche Versuchs-anstalt für Grundbau und Wasserbau, Franzius
Institut der T. H. Hannover

065

THE ABSORPTIVE ABILITY OF SANDS FOR PETROLEUM PRODUCTS, HANNOVER, 1960

W. Hensen

066

INVESTIGATION OF THE PERMEABILITY OF SANDY SOIL TO PETROLEUM

W. Hensen; and W. Krolewski

Versuchs Bericht (1959) Franzius Institut der T. H. Hannover

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ON THE BEHAVIOR OF PETROLEUM IN THE GROUND

F. Krolewski

Franzius Institut der T. H. Hannover (1959), No. 16, p. 191.

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BEHAVIOR OF PETROLEUM IN THE GROUND

H. Krolewski

Erdöl und Kohle, 14, p. 492, 1961.

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CONTAMINATION OF THE GROUND BY HEATING OIL AND MEASURES FOR ITS PREVENTION

W. Langer

Ges. Ing., 83, pp. 89-95, 1962.

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M. C. Leverett; W. B. Lewis; and M. E. True

Petr. Techn., January 1942.

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F. O. Miller

U.S. Bur. of Mines, R.I. 3595, 1941.

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INVESTIGATION OF A CASE OF UNDERGROUND CONTAMINATION BY DIESEL FUEL

F. Schwille; and H. Krieger

Wasser und Abwasser, pp. 164-170, 1962.

073

RECOMMENDATIONS CONCERNING THE QUESTION OF PROTECTION OF GROUND WATER
AGAINST CONTAMINATION BY STORED LIQUIDS

W. Zimmermann

pp. 34-37, 1959.

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1.4.2.2 DEMONSTRATION OF OIL IN WATER

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074

A METHOD OF QUANTITATIVE DETERMINATION OF CONTAMINATION OF DRINKING AND UTILITY WATER BY MOTOR FUEL AND SIMILAR SUBSTANCES

W. Albersmeyer

Städtehygiene, pp. 85-87, 1958.

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ODOR AND TASTE OF PETROLEUM PRODUCTS

G. van Beneden

Bull. mens: du Cebedeau, p. 95, 1960.

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F. Dangl; and B. Nietsch

Mikrochem. Verein. Mikrochem. Acta, 39, p. 333, 1952. (Ref.: Z. Annal. Chem., 140, p. 388, 1953.)

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H. Eilers

Water, Boden en Lucht, 50, pp. 58-81, 1960.

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SEVERE GROUND-WATER CONTAMINATION BY GASOLINE AT WESEL

K. Fricke; and Krause-Wichermann

Ges. Ing., 74, p. 394, 1953.

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CONTAMINATION OF DRINKING WATER BY PETROLEUM, AND EXPERIMENTAL ATTEMPT TO DETECT IT BY MEANS OF LUMINESCENCE ANALYSIS

J. Halstrick

Arch. Hyg., 128, p. 155 f., 1942.

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FATTY OILS TO REMOVE TASTE AND ODOR

L. M. Klinge

Water and Sewage Works, 106, pp. 237-238, 1959.

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SAMPLING FOR THE INVESTIGATION OF SOIL CONTAMINATION

S. J. Meijn

Water, 46, pp. 194-195, 1962.

082

DETECTION OF PETROLEUM PRODUCTS IN NATURAL WATERS THROUGH FLUORESCENCE

B. Nietsch

Augen. Chemie, 66, p. 571 f., 1954.

Mikrochim. Acta, p. 171, 1956.

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THREAT TO THE DRINKING WATER SUPPLY FROM GASOLINE AND OTHER MOTOR FUELS
W. Zimmermann
Städtehygiene, p. 216, 1955.

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INFLUENCE ON DRINKING WATER BY PETROLEUM PRODUCTS
W. Zimmermann; G. Lehmann; F. Schwille; and E. Schmeidler
Ztschr. Hyg., 142, pp. 322-338, 1956.

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PETROLEUM AND TAR PRODUCTS IN GROUND AND DRINKING WATER
W. Zimmermann
Korresp. Abwasser (Köln. Vortr. Voraustellung d. Zweckvern. f.
Kanalisationsförderung 2V (16.4. 1958).

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AGAINST CONTAMINATION FROM STORED LIQUIDS, pp. 24-33, 1959.
W. Zimmermann

1.4.2.3 CASES OF OIL CONTAMINATION

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RECOMMENDATION CONCERNING THE QUESTION OF PROTECTION OF GROUND WATER
AGAINST CONTAMINATION FROM STORED LIQUIDS, pp. 35-49, 1959.
Michels; Nabert; Udluft; and Zimmermann
(German, Austrian, Swedish and Swiss cases.) With bibliography.

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SWISS EXPERIENCES CONCERNING INFLUENCES OF MOTOR FUELS AND OILS ON THE
GROUND WATER, WITH RELIEF MEASURES
P. Heins
Ges. Ing., 78, pp. 210-212, 1957.

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THE ADVERSE INFLUENCE OF ANY TYPE OF ORGANIC MATTER ON THE QUALITY OF
UNDERGROUND WATER AND THE WAY AND MEANS OF CONTROLLING SUCH RISKS IN
SWEDEN
A. Ullerstam
Vattonhygien, 12, p. 81, 1956.

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R. Buydens

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CONTROL OF THE OIL NUISANCE
Anonymous
Gewässerschutz mit der Schweizerischen Vereinigung für Gewässerschutz,
p. 112, 1962.

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K. Fricke; and Krause-Wichmann

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GWF, 96, p. 466, 1955.

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F. Kassecker

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F. Meinck

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SIGNIFICANT DETERMINATIONS CONCERNING GROUND-WATER CONTAMINATION BY
GASOLINE

J. Müller

GWF, 93, pp. 205-209, 1952.

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TANK TRUCK ACCIDENT IN THE VICINITY OF A WATERWORKS

E. A. Schaak; P. Weyer; and H. Lotzing

GWF, 102, pp. 1105-1108, 1961.

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CONTAMINATION OF GROUND WATER RESULTING FROM LEAKAGE OF PETROLEUM

W. Schneider

Ges. Ing., 79, pp. 326-329, 1958.

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INVESTIGATION OF A CASE OF UNDERGROUND CONTAMINATION BY DIESEL FUEL

F. Schwille; and H. Krieger

Wasser und Abwasser, pp. 164-170, 1962.

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ON OIL CONTAMINATION OF SURFACE AND UNDERGROUND WATER

K. Stundl

Symposium der Föderation Europäischer Gewässerschutz, p. 12, 1959.

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TANK TRUCK ACCIDENT IN THE VICINITY OF A WATERWORKS

H. Rothard

GWF, 103, pp. 248-249, 1962.

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CONTAMINATION OF GROUND WATER BY WASTE PRODUCTS OF THE PETROLEUM INDUSTRY
W. A. Piringer
Mitt. d. Österr. San. Verw., 51, p. 153, 1950.

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THREAT TO GROUND AND SURFACE WATERS THROUGH STORED LIQUIDS
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W. Zimmermann
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THREAT TO THE DRINKING WATER SUPPLY THROUGH LEAKAGE OF LIQUID FUELS
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1.4.2.4 TECHNICAL PREVENTIVE MEASURES

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GROUND WATER AGAINST CONTAMINATION BY STORED LIQUIDS
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RECOMMENDATION CONCERNING THE QUESTION OF PROTECTION OF GROUND WATER AGAINST
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P. Schläpfer

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Symposium Föderation Europäischer Gewässerschutz, pp. 7-11, 1959.

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CATHODIC PROTECTION OF UNDERGROUND PETROLEUM CONTAINERS

O. Ettinger

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CORROSION, INSULATION, AND CATHODIC PROTECTION OF UNDERGROUND
PETROLEUM STORAGE TANKS

H. Groebler

Erdöl und Kohle, 14, p. 569, 1961.

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PROTECTION OF THE GROUND WATER AGAINST CONTAMINATION BY HEATING OIL

F. Hess

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ACCORDING TO DIN 6608 AND THE MATERIAL SPECIFICATIONS

M. Jansen

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W. Langer

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E. Schibli

Mitteilungen der Schweiz. Ver. für Gewässerschutz, p. 111, 1962.

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H. Straub

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PETROLEUM STORAGE AND WATER PROTECTION

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Mineralölwirtschaftsverband e. V. Hamburg, (October 1962).

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H. O. Rasche

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TDCK 26096

REMOVAL OF RADIOACTIVE MATERIALS FROM WATER BY THE WATER PURIFICATION UNIT, HAND-OPERATED, KNAPSACK-PACK, FILTER-PAD-TYPE, 1/4-GPM, AND BY A FIELD EXPEDIENT

W. J. Lacy; et al.

Armed Services Technical Information Agency, Report No. 1404, 31 pp., May 19, 1955. 8 refs., 11 figures and 1 diagram.

Tests were conducted at Fort Belvoir, Virginia and Oak Ridge, Tennessee, evaluating the Water Purification Unit, Hand-Operated, Knapsack-Pack, Filter-Pad-Type, 1/4-GPM, and a field expedient for removing radioactive contaminants from water.

138

TDCK 26095

REMOVAL OF RADIOLOGICAL WARFARE AGENTS FROM WATER (SALTY DOG V)

W. J. Lacy; and D. C. Lindsten

Armed Services Technical Information Agency, Report No. 1396, 19 pp., April 22, 1955. 5 refs., 5 figures, 6 tables and 2 diagrams.

This report describes tests conducted at the Sanitary Engineering Branch Water Supply Test Station, Oak Ridge National Laboratory on the removal of radiological warfare agents from water.

The report concludes that:

- (a) Coagulation with ferric chloride and limestone is capable of removing 94 percent of tantalum 182 and 98 percent of zirconium 95-niobium 95 from water.
- (b) Certain slurry adsorptive materials, such as clay or powdered iron, are effective decontaminants. However, because of variable efficiencies, selection must be made on the basis of the contaminant in question. For example, powdered iron removes 99.7 percent of tantalum 182 from water, but only 35.2 percent of waste concentrate.
- (c) Mixed bed ion exchange resins used as a column are capable of removing protactinium 233 and zirconium 95-niobium 95 in the range of 92 to 99.9 percent.
- (d) Thermocompression distillation is effective for removing radiological warfare agents from water. With protactinium 233, aged fission products, and waste concentrate, removals of 99.96 percent, 99.98 percent, and 99.72 percent, respectively, can be obtained.
- (e) Water Purification Unit, Hand-Operated, Knapsack-Pack, Filter-Pad-Type, 1/4-GPM is capable of removing 97.0 percent of tantalum 182 and 79 and 1 percent of zirconium 95-niobium 95 from water. The removal of tantalum 182 can be increased to 99 percent by the use of a preslurry treatment with clay or powdered iron. The removal of zirconium 95-niobium 95 can be increased to 95 to 96 percent by use of a similar treatment.
- (f) A field expedient, consisting of passing contaminated water through a column packed with sand, gravel, humus, clay, and coarse vegetation, is capable of removing from 95 to 99 percent of radiological warfare agents.

139

TDCK 26093

PURIFICATION OF WATER CONTAMINATED WITH RADIOACTIVE MATERIAL "WAHOO"

W. J. Lacy; and D. C. Lindsten

Armed Service Technical Information Agency, Report No. 1275, 76 pp., Dec. 24, 1952. 12 figures, 29 tables and 12 diagrams. AD 14230.

This interim report covers the results of a laboratory and field evaluation of the applicability and limitations of Army field water supply equipment and water treatment processes now standard and under development with respect to radioactive contamination and decontamination. Work is still in progress on the project.

140

TDCK 26094

REMOVAL OF RADIOACTIVE MATERIALS FROM CONTAMINATED WATER BY THERMOCOMPRESSSION DISTILLATION "WAHOO II"

W. J. Lacy; and D. C. Lindsten

Armed Service Technical Information Agency, Report No. 1313, 45 pp., Aug. 28, 1953. 7 refs., 7 figures, 21 tables and 1 diagram.

This report describes experimental work accomplished under Projects 8-75-05-008 "WAHOO" at Oak Ridge National Laboratory, Oak Ridge, Tennessee, by personnel of the Sanitary Engineering Branch, Engineering Research and Development Laboratories, Fort Belvoir, Virginia, pertaining to the removal of radioactive materials from contaminated water by thermocompression distillation.

As a result of the work it is concluded that:

- (1) Thermocompression distillation is effective for decontaminating radioactively contaminated water. With mixed fission product contamination, such as might result from an atomic bombing, a decontamination factor of 4.97×10^3 (99.98 percent removal) can be realized.
- (2) Thermocompression distillation is effective for decontaminating water contaminated with protactinium 233 and waste concentrate from atomic energy plants, two potential radiological warfare (RW) agents. With protactinium 233, a decontamination factor of 2.31×10^3 (99.96 percent removal) can be realized and with waste concentrate a decontamination factor of 3.52×10^2 (99.72 percent removal) can be accomplished.
- (3) The effectiveness of thermocompression distillation for the decontamination of radioactively contaminated water can be improved by the addition of a steam filter. An improvement of about 10 in the decontamination factor can be realized. Due to weight, size, and operating difficulties, the use of filters in the field is contra indicated. The effectiveness of thermocompression equipment for the decontamination of radioactively contaminated water is directly related to the quality of its design and to the degree of operator training.

141

TDCK 14601

RADIOACTIVE SUBSTANCES IN WATER

Water Pollution Research, pp. 85-89, 1957. 1 figure, 2 tables and 2 diagrams.

Work at present in progress includes survey work, comprising the examination of samples of rain water and of samples of water, mud, and vegetation from the local rivers. This is to be complemented by tracer-level investigation in the laboratory of the rate and extent of the uptake of certain fission products by specimens of aquatic plants and muds taken from the local rivers.

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ANCAIOS: RADIOACTIVE EFFLUENTS AND THE PORT AUTHORITY. A SHORT EXAMINATION OF THE PRESENT POSITION

Dock & Harb. Authority, 38, H. 445, pp. 260-261, 1957. 9 refs.

The prevention of damage from radioactive waste has also become a problem for harbor authorities. Information must therefore include the following: annual amount of radioactive drainage; kinds of radioactive materials contained in the drainage, i.e., indication of the isotope names, form of their radioactivity, maximum concentration of radioactive materials in the drainage; minimum tidal current during neap tide, actual dilution, total outflow rate of the river water into the sea.

Highest permissible radioactive discharge per day is calculated by a rule of thumb formula.

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F 13995

DECONTAMINATION OF SMALL VOLUMES OF RADIOACTIVE WATER

R. A. Lauderdale; and A. H. Emmons

Nucleonics, 8, pp. 21-26, May, 1951. 5 refs., 5 figures and 2 tables.

A simple apparatus capable of reducing the activity level of water from

2.5 to 10^4 c/ml is described.

Experimental results indicate it could be used successfully, following an atomic attack, to treat emergency water supplies. It has been found possible to decontaminate highly radioactive water to a level well below the emergency concentration permissible for drinking water, with a compact unit constructed of readily available materials. Water in which radioisotopes resulting from fission had been mixed has been processed to give a

product containing less than 10^{-4} microcuries of activity per milliliter, a concentration presenting little biological hazard. It is some one hundred times less than the maximum permissible concentrations of the order

of 10^{-2} c/ml that have been suggested (1-3) for both alpha and beta contamination as acceptable for emergency use for a period of from one week to ten days.

Although the experimental work is not yet completed, the interest shown in the development has prompted this progress report on the work to date.

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PURIFY RADIOACTIVE WATER

Science News Letter, 82, No. 12, p. 188, Sept. 22, 1962.

Clay and loose subsoil can effectively remove 80 to 90 percent of the radioactive strontium and cesium. William J. Lacy, Office of Civil Defense, Washington, D.C., discussed this at the American Chemical Society meeting in Atlantic City. An ounce of clay is enough to remove most of the strontium 90 from a gallon of water under some conditions, while cesium 137 can be removed three times as efficiently, the chemist said.

About 85 percent of the strontium is removed by stirring clay with the water and more than 90 percent by letting the water flow through a column of the clay.

In the event of nuclear war, the primary hazard is not contamination by biological ingestion, Mr. Lacy told Science Service, since external damage from direct radiation would be fatal. A local pool or well that is thought to be contaminated, however, can be filtered locally and effectively with flower pot soil, paper towels, and commercial bleach, he said. The disposal of radioactive wastes is an even greater problem, he continued, since the material is soluble and more biologically available, if not properly stored.

By adsorbing the radioactive material onto the clay, the storage problem can be reduced many hundredfold. The soils tested, ranked in order of their ability to remove strontium 90 were: Consauga shale, Fithian ill, New Mexico kaolinite, Wyoming bentonite, North Carolina vermiculite, and Utah halloysite.

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TDCK 39061

THE DANGER TO THE WATER SUPPLY OF THE ROTTERDAM MUNICIPALITY FROM RADIOACTIVE FALLOUT

J. Blok

RVO/TNO Ned. Biol. Lab., No. MBL/1964/13, pp. 10-13, May 1964. 4 refs.

A total uptake of iodine 131, strontium 89, strontium 90 and of a mixture of fission products which would be acceptable in wartime is deduced. From this an acceptable concentration of these radioactive materials is calculated for the drinking water supplied by the municipal waterworks at Rotterdam.

It is shown that iodine 131 and the total radioactivity determine the risk. The principal danger of radioactive fallout for the Rotterdam drinking water supply is contamination of the catch basin

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$(8 \times 10^6 \text{ m}^3)$ on the Beerenplaat.

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DETERMINATION OF RADIOACTIVITY IN WATER

Draft 2396-61

Netherlands Standardization Institute, The Hague, 2 pp., March 1961.

147

TDCK 14407

STUDIES OF RADIOACTIVITY IN THE CHICAGO WATER SUPPLY

James C. Vaughan

Am. Inst. of Chem. Engineers, 16 pp., 1958. 7 refs. and 8 figures.

Chicago has continuously monitored the water supply at its South District Filtration Plant for the past 6 years. For over 3 years more precise examinations have been made each day on samples of raw and treated water. The level of activity in the raw water has usually been quite low, general-

ly less than 10^{-8} c/ml.

The ratio of raw water activity to finished water activity is shown. On very limited data the decontamination factor is 1.6, amounting to approximately 40 percent radioactivity removal by the usual plant treatment processes at the very low levels present.

During periods when nuclear weapons are being tested, particularly follow-

ing rains, the raw water activity may reach a peak of more than 10^{-7} c/ml. This level is subject to decline due to decay and other natural causes. Some studies of the rate of decline have been made. A limited amount of work is being done to determine the specific nature of radioactivity in

the lake water. Analysis for I^{131} and Sr^{90} are in progress. Preliminary

results indicate the presence of I^{131} in the lake water at expected levels. Samples of rain and snow from rain gauges located at five points throughout the city are regularly examined for radioactivity. The level of activity of these samples follows the frequency of nuclear explosions with due allowance for meteorological conditions.

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TDCK 14408

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THE ADSORPTION OF RADIOACTIVE SUBSTANCES ON WATERBORNE AND CONSOLIDATED MATERIALS

F. B. Barker

Am. Inst. of Chem. Engineers, 25 pp., 1958. 9 refs. and 3 figures.

Adsorption is a phenomenon that has a direct bearing on the transport and distribution of radioactive substances in surface and ground water. The rate of adsorption of radioactive substances and the quantity adsorbed are related to the composition of contaminants in the liquid form, to the chemical quality of the natural water involved, and to the minerals present and their ion-exchange capacity.

Preliminary results of some studies of this type are discussed.

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G 31739

DRINKING WATER AND RADIOACTIVITY

K. Hünerberg

Zivilschutz, 25, No. 5, pp. 161-164, May 1961.

Ground water is relatively well protected from the intrusion of radioactive substances compared to surface water, which is exposed to a substantially greater danger through radioactive materials contamination. But because the surface water, when it is used as raw material for the drinking water supply, usually is not delivered directly to the consumer without processing, a certain reduction of the danger element may be implied.

The danger to the water supply from cisterns, which are still used in the coastal districts, is very great however.

Both slow and fast filters remove a very small part of the dissolved radioactive materials from the water. Their principal function lies in the removal of such radioactive materials as are embedded in particles and flakes. The purifying effect with respect to radioactive substances is not very high for fast filters. It amounted to only 20 percent as was determined in the waterworks of New England after the atomic bomb tests in Nevada. Further possibilities for the removal of radioactive substances from the water were investigated with the calcium-soda softening process. This process is very effective. For the decontamination of cistern 155 water, which even now often exceeds the tolerance concentration for drinking water by a substantial amount because of radioactive fallout, filtration through Jurassic peat has been tried. It is supposed to be possible with this substance to hold back 95 percent of the radioactivity present in rain water. With artificial addition of strontium 90-yttrium 90, the effectiveness amounted to 98 percent. In order to increase the throughput rate in the purification system, the Jurassic peat is mixed with sawdust. At the water intake point a thin layer of sand causes a part of the radioactivity to be concentrated in the upper layers. The best protection of the water supply against contamination by radioactive substances is presented only by a satisfactory removal of radioactive waste at the point of origin. This neutralization is a serious problem. No doubt radioactive substances can be held back to a certain degree by layers of soil, so that first and foremost ground water originating at greater depths will offer substantially greater security against radioactive contamination than surface water. Attempts should therefore be made more than ever to use ground water for the central water supply, if possible.

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EVALUATION OF THE GROUND-WATER CONTAMINATION HAZARD FROM UNDERGROUND NUCLEAR EXPLOSIONS

G. H. Higgins

University of California, Livermore Site, for the U.S. Atomic Energy Commission. Order UCRL-5538 from OTS, U.S. Department of Commerce, Washington 25, D.C., 25 pp., April 1959.

Information available would seem to indicate that hazards arising from underground nuclear explosions did not create serious water contamination problems. A sampling of the water from two explosion sites showed the radioactivity to range from 1 to 10 micro-microcuries per milliliter. This range was about what was expected for this particular region and was well below the maximum permissible for human consumption. Distribution coefficients for adsorption ranged from 50 to 500,000 depending on the particular fission product and mineral. A theory pertaining to the flow of activity in an ion-exchange medium is presented, and equations for application of laboratory data to field experiments are included.

Some of the available distribution coefficients are tabulated from 156 the literature on waste disposal.

See also: LITERATURE IN THE POSSESSION OF THE DIVISION FOR RADIOACTIVE WATER CONTAMINATION OF THE RIZA, Westeinde 3A, Voorburg.

2. SEWAGE PURIFICATION

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2.1 LIST OF THE MOST IMPORTANT JOURNALS

- (1) "Water"
- (2) "Gas and Water Specialty: Water, Sewage"
- (3) "Water and Sewage Works"
- (4) "Water Works and Wastes Engineering"
- (5) "Journal and Proceedings of the Institute of Sewage Purification"
- (6) "Journal Water Pollution Control Federation"
- (7) "La Tribune du Cebedeau"
- (8) "Water Documentation" (Abstract journal)
- (9) "Literature Report on Water, Sewage, Air and Soil" (Abstract journal)
- (10) "Water Pollution Abstracts".

2.2 INTRODUCTORY HANDBOOKS AND OTHER PUBLICATIONS

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RIZA

HEALTH CARE FOR THE NETHERLANDS SURFACE WATERS

J. J. Hopmans

National Institute for the Purification of Sewage. 24 pp., 1955. 20 figures.

A brief survey is presented concerning the following subjects:

- (1) The water economy of the Netherlands
- (2) Purpose of sewage purification
- (3) Efficient sewage removal
- (4) The economic side of the sewage problem
- (5) Natural and artificial purification
- (6) The fundamentals of sedimentation and flocculation
- (7) The monopoly of the living cell
- (8) The technique of sewage purification
- (9) Cost of sewage purification
- (10) Industrial waste water
- (11) Sewage purification in the Netherlands
- (12) Organization of the control.

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RIZA A 158

SEWAGE PURIFICATION

W. Ortleb; and B. Kadner

VEB Verlag Technik, Berlin, 173 pp., 1958. 42 refs., 69 figures and 27 tables.

Table of contents:

- (1) Sewage, pollutants, sewage quantity
- (2) Sewage discharge, main canals
- (3) Purpose of purification
- (4) Purification process and design of structures
- (5) Choice of purification process
- (6) Measuring devices for settling process
- (7) Planning and projecting of plants
- (8) Plant operation

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- (9) Standards for sewage purification
- (10) Bibliography
- (11) List of examples.

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RIZA C-137-1

INDUSTRIAL WASTE WATER

Publication series of the Society for Water, Soil, and Air Hygiene, No. 6
F. Meinck; H. Stooff; B. Weldert; and H. Kohlschütter
G. Fischer Verlag, Stuttgart, 517 pp., 1953. 1001 refs., 120 figures and
100 tables.

Detailed and comprehensive description of industrial and trade waste waters
and the procedures for their purification and removal.

Table of contents:

- (1) Origin, quantity, composition, and characteristics of industrial
waste waters
- (2) Removal
- (3) Choice of purification plants
- (4) Industrial waste waters according to origin and composition: Mines,
metallurgical industries; chemical industries, food products industry,
waste processing plants, fuel processing industry. Paper, textiles
and plastics industry.
- (5) Toxic effect on plants and animals
- (6) Population equivalents of industrial plants
- (7) Degree of contamination and dilution ratio of industrial waste waters
with respect to the drainage canal.

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SEWAGE TREATMENT, BASIC PRINCIPLES AND TRENDS

R. L. Bolton; and L. Klein

London Butterworths, 161 pp., 1961. 88 refs. and 19 figures.

This book deals with the basic principles of the process of sewage treat-
ment and provides the framework on which a comprehensive knowledge of the
subject can be built.

It has a bias towards the chemistry of sewage.

Contents:

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- (1)-(2) Nature of sewage and chemical analysis
- (3) Sewerage systems, storm water overflows, and storm water treatment
- (4) Preliminary treatment
- (5) Primary sedimentation
- (6) Aerobic biological treatment
- (7) Methods of improving final effluents
- (8) Sludge disposal
- (9) Effects of trade wastes
- (10) Small sewage treatment plants
- (11) Trends in the treatment of sewage.

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RIZA A-85-2

POCKET BOOK OF CITY DRAINAGE

K. Imhoff

Munich, R. Oldenbourg Verlag, 335 pp., 1954. 87 figures.

City drainage

- (1) Fundamentals of city drainage
- (2) Calculation of the main system
- (3) Statistical calculation of cross sections

Sewage treatment

- (4) General information about sewage treatment
- (5) Calculation and planning of treatment plants: character of the sewage, filtration process, flotation process, settling process, chemical precipitation, chlorine, sand filters, biological processes, sludge treatment, industrial waste waters, rain water, other installations
- (6) Waste water discharge into water courses: demands on the water courses. Waste water load plan, kind of waste water delivery, purification plants, circulation
- (7) The self purification of water courses
- (8) British and American measures
- (9) Standards in the field of waste water practice.

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RIZA A 212

/61

SMALL SEWAGE TREATMENT PLANTS

C. Schubert

VEB Verlag Technik, 200 pp., 1954. 37 figures.

In connection with the drainage of a small site it is of fundamental importance to distinguish between cases where simple cleaning devices suffice (gratings, sieves, fat, oil, gasoline separators, and sand traps) or where additional sludge removing installations and further mechanical and biological treatment installations are required: finally, when these treatment installations are to be combined with a disinfection facility.

The following subjects are discussed:

- (1)(2) Choice of purification process
- (3) Simple treatment devices
- (4) Small treatment plants
- (5) Disinfection
- (6) Examples
- (7) Utilization of waste water, treatment of extracted materials
- (8)-(12) Operational viewpoints, regulations, supervision, the sea.

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RIZA A-232-2

TREATMENT PLANTS FOR SMALL- AND MIDDLE-SIZED COMMUNITIES WITH OR WITHOUT INDUSTRIAL WASTE WATERS

H. Lieberman; et al.

Vol. 10, Münchener Beiträge zur Abwasser, Fischerei- und Flussbiologie

R. Oldenbourg Verlag, Munich, Vienna, 367 pp., 1963. 180 figures and 65 tables.

This volume contains the most important lectures presented in connection with the 1962 fall course on waste water, with supplementary papers. An

attempt is made to demonstrate with many examples how treatment plants for small- and middle-sized communities can be built and operated. Thereby special attention is given to the treatment of various industrial waste waters which enter the common treatment plant through community sewer systems. In a concluding chapter a resume of the most important findings of this book and their practical consequences is presented. /62

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RIZA D-154

THE OXIDATION PIT

A. Pasveer

Continuation course EAWAG, 1964. Eidg. Techn. Hochschule, Zurich. 25 pp., 8 refs. and 3 figures.

In the oxidation pit, the volume of the facility and the oxygen supply are adjusted so that after treatment of the raw sewage which is not pretreated, a biologically cleaned discharge can be readily separated from a sludge, which is mineralized to such an extent that this sludge can be dried without giving off any odor. There is no pretreatment and no sludge putrefaction.

The theoretical basis for dimensioning of the oxidation pit is discussed. A discharge low in nitrogen can be produced.

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RIZA B-35-2

SEWERAGE SYSTEMS II

J. van der Akker; et al.

Sijthoff, Leiden, 463 pp., 1955. 192 refs. and 471 figures.

In continuation of Sewerage Systems I theory, part II has reference to the building of sewerage systems, treatment facilities, etc.

- (1) Conditions set by the building regulations, examples
- (2)-(7) Details of pipe lines
- (8)-(9) Layout, specifications, and problems of soil mechanics
- (10) Technique of sewage purification.

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TDCK 9740

/63

SEWAGE AND WASTE DISPOSAL; SEWAGE TREATMENT PLANTS

Department of the Army, pp. 1-40, June 1956.

The purpose of this chapter is to furnish general information for guidance in planning and basic design data for use in the design of sewage treatment plants. This is not intended to be a textbook. Training in the principles of sanitary engineering is essential to proper application of the criteria set forth herein to actual design and it is assumed that the designer will have this basic training. General information is presented in paragraphs 3-01 to 3-05 inclusive. The remainder of the chapter relates more specifically to design.

Sewage treatment plants should be of as simple and of such type of treatment requiring a minimum amount of technical skill and training of the operating personnel as may be commensurate with the required degree of treatment and the economic considerations. It is assumed that the plants will be capable of treating the normal laundry wastes, together with the sanitary sewage. Plants for the pretreatment of laundry wastes therefore should not be considered except at locations where existing treatment works are overloaded or where the pretreatment of the laundry wastes would obviate the necessity for enlarging the sewage treatment works. At certain

ordnance plants, chemical warfare plants, and repair bases, there may be unusual industrial wastes which would require special treatment. Design data for such treatment are not included in this chapter. In the design of additions to existing treatment plants, the criteria contained herein may be modified to conform to the performance data of the existing plant if such data can be relied upon for accuracy.

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BC 1

THE CONSTRUCTION OF A SEWAGE TREATMENT INSTALLATION AT THE CAMPSITE AT MILLIGEN

A. Feenstra

Genie, 9, No. 6 and 7, pp. 121-129, 156-164, June, July, 1959. 10 figures. The disposal of sewage from the military camp, formerly remount depot, near NW Milligen, originally took place by means of scattered latrines and cess-pools, later by a sewer system, as an emergency measure, debouching /64 into two liquid settling fields dug for the purpose which were silted up and evil smelling and no longer satisfactory.

The building of a sewage treatment plant that was made necessary by this situation is described: general fundamentals, cleaning requirements, pump construction, preliminary settlement (Imhoff tank), biological purification (oxidation bed) after settlement (humus tanks), sludge fermentation, sludge removal and drying, compost storage tank. In the second part the construction of the facility is described: foundations, work, framing, concrete work, humus tanks, concrete protection, and finally operation and maintenance.

2.3 SPECIAL ASPECTS

/65

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A NEW METHOD FOR THE FILTRATION OF LIQUIDS

L. C. H. v. d. Berg

Bedrijf en Techniek, 12, No. 271, pp. 46-48, Jan 26, 1957. 3 figures and 2 tables.

It was formerly common practice to let the filtration of liquids take place in downflow over a bed of loose granular material, for example, sand or gravel. Also other filtration methods were frequently adapted in the past according to the nature of the matter, especially for liquids in which the material to be filtered out occurred in such a form that filtration over sand or gravel met with difficulties.

The purpose of the article is to give the reader an understanding of the disadvantages of the classic downflow filtration over a filter bed of sand and gravel, with reference to the advantages of the new method to be described thereafter.

The new method. As a consequence of the natural gradation in downflow filtration, there will be an unacceptable increase in filter resistance due to absorption in the finest gravel layers earlier than would be possible if there were upflow filtering. In the latter case the liquid to be filtered first passes the widest capillaries between the coarsest gravel layers and as the filtration cycle proceeds the narrower capillaries in the finer gravel layers will become clogged, just as in downflow filtration. The big difference between the two filtration systems is that with upflow filtration the above mentioned unacceptable filter resistance is reached at a much later stage than with downflow filtration. In an upflow filter so

called "packing space" for the material to be filtered out is utilized practically 100 percent, while with downflow filtration this is only 10 percent, because of the closing up of the uppermost gravel layer.

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THE SIGNIFICANCE OF GREEN ALGAE IN THE PURIFICATION OF SEWAGE

Ph. A. M. Jansen

De Ingenieur, 74, No. 31, pp. G39-G43, Aug. 3, 1962. 24 refs. and 8 figures.

The use of green algae in sewage treatment. The publications of American investigations in the cultivation of green algae in sewage show that quantities of organic material can be harvested from comparatively small surface areas and in rather short periods of time.

The cultivation will be efficient only then if an economical improved method is found to separate the algae from the sewage effluent.

The paper describes how the bacteria from the sewage can stick the green algae together. The laboratory studies indicate a cut in the expenses of a sewage treatment plant by coupling it with an algae farm using the method mentioned above.

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Kon. Mil. Ac. Breda

COMPLETE NITROGEN ELIMINATION FROM SETTLING WATER IN CONNECTION WITH AN OVERHEAD PIPE METHOD

G. Bringmann

Gesundheits-Ingenieur, 82, No. 8, pp. 233-235, Aug. 10, 1961. 1 figure.

A process has been developed for complete nitrification of sewer water having an ammonium N content of 960 mg/l with a nitrification capacity of 128 mg ammonium N/l activated sludge per hour by means of nitrifying, carbonic acid-assimilating bacteria in the aerating process with gasification with CO₂ and addition of CaCO₃ and FeSO₄. This capacity corresponds to a

complete nitrification of the nitrogen in 3.2 cubic meters sewer water/cubic meters activated sludge in 24 hours.

During the test period a complete denitrification of the nitrified sewer water could be achieved in 45 minutes with city sewage at a dilution of 1:70, corresponding to conditions in presettling basins of sewage treatment plants.

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/67

THE RESIDENT EQUIVALENT VALUE FOR INDUSTRIAL WASTE WATER

F. Meinck

Gesundheits-Ingenieur, 76, No. 15, pp. 225-229, 1955. 1 ref. and 1 table.

The definition of the term "resident equivalent value" is a reference magnitude calculated from the biochemical oxygen requirement of the waste water and its amount. The purpose of this calculation is to establish a relationship between organically contaminated industrial waste water and city (mostly household) sewage with reference to the effect on the oxygen economy of water courses or of biological treatment plants. Contamination coefficients as a measure of total contamination, sewage plans, and correction of resident equivalent values are discussed. A resume is given.

166

STATE AND DEVELOPMENT TRENDS OF WASTE WATER PURIFICATION WITH SPECIAL REFERENCE TO INDUSTRIAL WASTE WATERS

Wilh. Husmann

Schweizer. Bauzeitung, 73, No. 4, pp. 50-54 and No. 6, pp. 69-75, 1955. 12 refs., 25 figures and 5 tables.

Industrial site selection is discussed. Industrial and domestic waste water from textile plants, food products industries, petroleum refineries, pickling plants, and phenol-bearing waste waters are discussed. Mishaps, design of the installations, and control and supervision of waste waters and treatment plants are also discussed.

167

DEVELOPMENT TRENDS IN WASTE WATER PURIFICATION

D. Kehr

Bauamt und Gemeindebau, 27, No. 6, pp. 171-177, 1954. 13 figures.

Because of failing ground-water feed of the water courses the contamination of the main canals, which already is severe, is becoming still greater. /68 The author does not intend to describe technical facilities for waste water purification, but rather to note trends which the development probably will follow.

Domestic and industrial waste water purification.

In the first case only efforts for economy in installation and operation remain. In the latter technically and economically satisfactory methods are still lacking. Methods must be found through experimental installations. Survey of current investigations and findings on rain overflow, grating installations, sand traps, settling basins, biological purification with high capacity percolating filters such as activating basins, Gould's step loading, and other methods are discussed.

168

W 3596-1 NIDER

GUIDE TO THE CLARIFICATION OF COAL WASHERY WASTE WATER

L. E. Gillenwater

Charleston, 41 pp., 1955.

State of West Virginia. - State Water Commission.

169

NETHERLANDS INVENTION IN THE FIELD OF WATER PURIFICATION

H. R. M. J. Kotte

Chemisch Weekblad, 53, No. 28, p. 387, July 13, 1957.

The disadvantages of a filter bed built up of several layers with different grain sizes and resting on a support layer can be obviated by use of a homogeneous filter bed, provided care is taken that the filter sand cannot penetrate through the openings in the cleaning system. The placing of "filter cups" in the bottom of the filter can answer these requirements. The first requisite for effective operation of the filter is that no sand penetrate through the filter cups and that the resistance of the cups be as low as possible so that there is no clogging.

Through close cooperation between Dorr Oliver N.V. and Ingenieursbureau N.V. Dorned, Amsterdam, filter cups according to Netherlands Patent 72434 are being manufactured, satisfying the above mentioned requirements, using

a super polyamide called Akulon which has been shown to be unsurpassed in the field.

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The installation of these filter cups is very simple. In the Netherlands the article is made available by Marram and La Porte, while for the world market it has been vested in N.V. Dorned in Amsterdam.

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PRINCIPLES OF FLOCCULATION RELATED TO WATER TREATMENT

P. D. Haney

Proceedings ASCE, 82, No. HY 4, Paper 1036, 11 pp., 1956. 26 refs. and 5 tables.

Flocculation requires the addition of a coagulant. The most commonly used agents are alum and iron oxide. Colloid particles play an important role in flocculation. Characteristics of colloid dispersion are a large specific surface, high absorption capability, and charging of the particles. The colloid particles present in natural waters are negatively charged, while the colloid particles formed at the start of coagulation can have a positive charge. Important factors in the coagulation process are the pH, dissolved solids, temperature, the time concentration (sic), coagulating agents, capability for ion exchange, and mixing.

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T.H.

WATER TREATMENT HANDBOOK

Transl. from the French by D. F. Long, 2d ed., Paris, Degrémont, Aofi, 561 pp., 1960. 19 cm, figures, bibliography on pp. 533-534, and 3 folded diagrams.

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Patent application /70

DEVICE FOR PURIFYING WASTE WATERS CONTAMINATED WITH SLOWLY SETTLING SOLIDS

H. Sontheimer

Metallgesellschaft A. G. Frankfurt am Main (Appl.)

Patent application DAS 1,143,455 (December 20, 1955)

From: Bohrtechn. Brunnenb. Rohrl. bau, 14, No. 7, p. 313, 1963.

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Patent application

SETTLING TANK OR SAND LAYING-UP BASIN FOR WATER PURIFICATION PLANTS, ESPECIALLY WASTE WATER PURIFICATION PLANTS

W. Schweizer

Passavan Werke Michelbacher Hütte at Michelbach

German patent application DAS 1,141,597. Appl. day, April 8, 1960

From: Bohrtechn. Brunnenb. Rohrl.-bau, 14, No. 2, p. 62, 1963.

174

METHOD FOR TREATMENT OF WASTE WATER AND THE LIKE

Dorr-Oliver Inc., Stamford, Connecticut, USA

Patent application No. 216,383 published July 15, 1963

Method for the treatment of waste water and the like, whereby activated sludge coming from an aeration or similar pretreatment step is subjected to a settling treatment in a settling tank, provided with a sludge collector, a part to which sludge is returned after the pretreatment step and clarified effluent is discharged from the tank via an overflow.

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Translated for the National Aeronautics and Space Administration by
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